Small Business Innovation Research/Small Business Tech Transfer

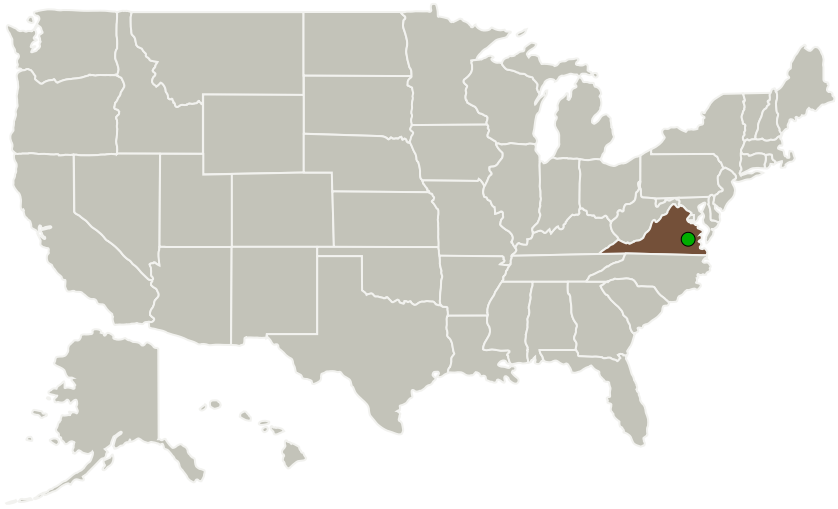
Additive Friction Stir Deposition of Aluminum Alloys and Functionally Graded Structures, Phase I

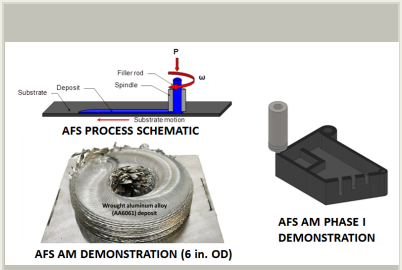
Completed Technology Project (2013 - 2013)

Project Introduction

State-of-the-art additive manufacturing technologies for metal parts have evolved around powder metallurgy and fusion welding-based processes. Both of these processing methodologies yield parts with inferior mechanical and physical properties as compared to wrought metal of the same composition. Additionally, the production rates for even the fastest processes are relatively low (~40 lbs/hr for Ti) and the part envelopes are limited to a few cubic feet. Aeroprobe proposes a highly scalable process for additive manufacturing of wrought metal structures based on their additive friction stir (AFS) process which provides high-strength coatings and welds (strengths comparable to the base metal UTS) while retaining a wrought microstructure. AFS has successfully deposited materials ranging from light metals, such as Al and Mg alloys, to high-temperature metals, such as Inconel 625 and oxide dispersion strengthened steels. Initial additive manufacturing demonstrations with AFS were highly successful and produced fully dense structures with wrought mechanical properties. The overall objective of this project is to further develop AFS technology into an additive manufacturing process to enable full-density, near net-shape fabrication of airframe structures. An initial process-structure-property relationship study will be conducted to demonstrate the physical and mechanical properties achievable in Al alloys via AFS. Finally, Aeroprobe will demonstrate the feasibility of AFS to produce complex 3D structures by fabricating an aluminum demonstration part of a relevant geometry.

Primary U.S. Work Locations and Key Partners





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Organizations Performing Work	Role	Type	Location
Schultz-Creehan Holdings Inc	Lead Organization	Industry Women-Owned Small Business (WOSB)	Blacksburg, Virginia
Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations
Virginia

Project Transitions

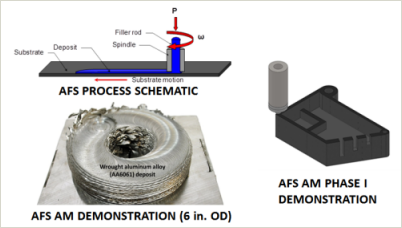
May 2013: Project Start

November 2013: Closed out

Closeout Documentation:

- Final Summary Chart*(https://techport.nasa.gov/file/140406)*

Images



Project Image
Additive Friction Stir Deposition of Aluminum Alloys and Functionally Graded Structures
(https://techport.nasa.gov/image/130568)

Organizational Responsibility

Responsible Mission Directorate:
Space Technology Mission Directorate (STMD)

Lead Organization:
Schultz-Creehan Holdings Inc

Responsible Program:
Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:
Jason L Kessler

Program Manager:
Carlos Torrez

Principal Investigator:
Kumar Kandasamy

Co-Investigator:
Kumar Kandasamy

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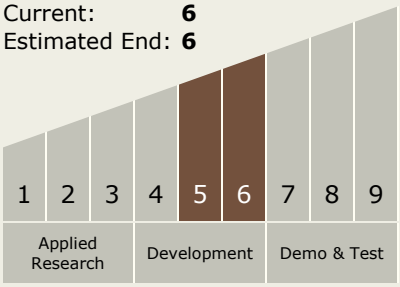
Completed Technology Project (2013 - 2013)

Technology Maturity (TRL)

Start: **5**
Current: **6**
Estimated End: **6**



Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.4 Manufacturing
    - TX12.4.1 Manufacturing Processes

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System